

WHAT IS CLAIMED IS:

1           1. An antenna, comprising:  
2            a first antenna array, comprising:  
3            one or more antenna elements of a first antenna element type in a first  
4            region of the antenna array; and  
5            a plurality of antenna elements of a second antenna element type in a  
6            second region of the antenna array.

1           2. The antenna as recited in claim 1, wherein the first region of the first  
2            antenna array is a central region, and the second region of the first antenna array is a region  
3            outside of the central region.

1           3. The antenna as recited in claim 1, wherein the first antenna array  
2            comprises a spacecraft antenna mounted on a spacecraft bus.

1           4. The antenna as recited in claim 1, wherein the first antenna array  
2            comprises a deployed spacecraft antenna.

1           5. The antenna as recited in claim 1, wherein the first antenna element  
2            type comprises a helical antenna element, and the second antenna element type comprises a  
3            planar element type.

1           6. The antenna as recited in claim 1, wherein first antenna element type  
2            comprises a helical antenna element type of a first length, and the second antenna element  
3            type comprises a helical antenna element of a second length.

1           7. The antenna as recited in claim 1, wherein the one or more antenna  
2            elements of the first antenna element type are configured on a spacecraft bus, and the  
3            plurality of antenna elements of the second antenna element type are configured on one or  
4            more deployed panels.

1           8. The antenna as recited in claim 7, wherein the first antenna element  
2            type comprises a helical antenna element, and the second antenna element type comprises a  
3            planar antenna element.

1                   9.        The antenna as recited in claim 1, wherein the one or more antenna  
2   elements of the first antenna element type and the plurality of antenna elements of the second  
3   antenna element type are configured on a spacecraft bus, and wherein the first antenna array  
4   comprises a plurality of antenna elements of a third antenna element type configured on one  
5   or more deployed panels.

1                   10.      The antenna as recited in claim 9, wherein the first antenna element  
2   type comprises a helical antenna element, and the second antenna element type and the third  
3   antenna element type comprise planar antenna elements.

1                   11.      The antenna as recited in claim 9, wherein the first antenna element  
2   type comprises a helical antenna element of a first length, the second antenna element type  
3   comprises a helical antenna element of a second length, and the third antenna element type  
4   comprises a planar antenna element.

1                   12.      The antenna as recited in claim 1, further comprising a second antenna  
2   array comprising one or more antenna elements.

1                   13.      The antenna as recited in claim 12, wherein at least some of the one or  
2   more antenna elements of the second antenna array are of the first antenna element type.

1                   14.      The antenna as recited in claim 12, wherein at least some of the one or  
2   more antenna elements of the second antenna array are of the second antenna element type.

1                   15.      The antenna as recited in claim 12, wherein the one or more antenna  
2   elements of the second antenna array comprise antenna elements of the first antenna element  
3   type and the second antenna element type.

1                   16.      The antenna as recited in claim 12, wherein the second antenna array  
2   has a coincident or overlapping frequency band as the first antenna array.

1                   17.      The antenna as recited in claim 12, wherein the one or more antenna  
2   elements of the second antenna array are interleaved with at least a portion of the antenna  
3   elements of the first antenna array.

1                   18.      The antenna as recited in claim 17, wherein the antenna elements of  
2   the first antenna array that are interleaved with the one or more antenna elements of the

3 second antenna array are of the first antenna element type, and at least a portion of the  
4 antenna elements of the first antenna array that are not interleaved with the one or more  
5 antenna elements of the second antenna array are of the second antenna element type.

1 19. The antenna as recited in claim 12, wherein the antenna elements of  
2 the first antenna array and the one or more antenna elements of the second antenna array are  
3 configured on a spacecraft bus.

1 20. The antenna as recited in claim 12, wherein the one or more antenna  
2 elements of the first antenna element type of the first antenna array and the one or more  
3 antenna elements of the second antenna array are configured on a spacecraft bus, and the  
4 plurality of antenna elements of the second antenna element type of the first antenna array are  
5 configured on one or more deployed panels.

1 21. The antenna as recited in claim 20, wherein the one or more antenna  
2 elements of the first antenna element type of the first antenna array and the one or more  
3 antenna elements of the second antenna array are interleaved, and wherein the first antenna  
4 element type comprises a helical antenna element, the second antenna element type  
5 comprises a planar antenna element, and the one or more antenna elements of the second  
6 antenna array comprise helical antenna elements.

1 22. The antenna as recited in claim 12, wherein the one or more antenna  
2 elements of the first antenna element type of the first antenna array, the plurality of antenna  
3 elements of the second antenna element type of the first antenna array, and the one or more  
4 antenna elements of the second antenna array are configured on a spacecraft bus, and wherein  
5 the first antenna array comprises a plurality of antenna elements of a third antenna element  
6 type configured on one or more deployed panels.

1 23. The antenna as recited in claim 22, wherein the first antenna element  
2 type comprises a helical antenna element, the second antenna element type and the third  
3 antenna element type comprise planar antenna elements, and the one or more antenna  
4 elements of the second antenna array comprise helical antenna elements.

1 24. The antenna as recited in claim 22, wherein the first antenna element  
2 type comprises a helical antenna element of a first length, the second antenna element type  
3 comprises a helical antenna element of a second length, the one or more antenna elements of

4 the second antenna array comprise helical antenna elements of a third length, and the third  
5 antenna element type comprises a planar antenna element.

1 25. The antenna as recited in claim 24, wherein the first length, the second  
2 length and the third length may all be different lengths, or two or more of the first length, the  
3 second length and the third length may be the same length.

1 26. The antenna as recited in claim 12, wherein the first antenna array  
2 comprises a Navigation Warfare Global Positioning System antenna.

1 27. The antenna as recited in claim 12, wherein the second antenna array  
2 comprises a Earth Coverage Global Positioning System antenna.

1 28. The antenna array as recited in claim 12, wherein at least one of the  
2 first antenna array and the second antenna array comprises a phased array antenna.

1 29. The antenna array as recited in claim 12, wherein at least one of the  
2 first antenna array and the second antenna array comprises an active phased array antenna.

1 30. The antenna as recited in claim 12, further comprising a third antenna  
2 array comprising one or more antenna elements.

1 31. A spacecraft, comprising:  
2 a spacecraft bus; and  
3 a first antenna array, comprising:  
4 one or more antenna elements of a first antenna element type in a first  
5 region of the antenna array; and  
6 a plurality of antenna elements of a second antenna element type in a  
7 second region of the antenna array.

1 32. The spacecraft as recited in claim 31, wherein the first region of the  
2 first antenna array is a central region, and the second region of the first antenna array is a  
3 region outside of the central region.

1 33. The spacecraft as recited in claim 31, wherein the first antenna array  
2 comprises a spacecraft antenna mounted on a spacecraft bus.

1                   34.     The spacecraft as recited in claim 31, wherein the first antenna array  
2 comprises a deployed spacecraft antenna.

1                   35.     The spacecraft as recited in claim 31, wherein the first antenna element  
2 type comprises a helical antenna element, and the second antenna element type comprises a  
3 planar element type.

1                   36.     The spacecraft as recited in claim 31, wherein first antenna element  
2 type comprises a helical antenna element type of a first length, and the second antenna  
3 element type comprises a helical antenna element of a second length.

1                   37.     The spacecraft as recited in claim 31, wherein the one or more antenna  
2 elements of the first antenna element type are configured on a spacecraft bus, and the  
3 plurality of antenna elements of the second antenna element type are configured on one or  
4 more deployed panels.

1                   38.     The spacecraft as recited in claim 37, wherein the first antenna element  
2 type comprises a helical antenna element, and the second antenna element type comprises a  
3 planar antenna element.

1                   39.     The spacecraft as recited in claim 31, wherein the one or more antenna  
2 elements of the first antenna element type and the plurality of antenna elements of the second  
3 antenna element type are configured on a spacecraft bus, and wherein the first antenna array  
4 comprises a plurality of antenna elements of a third antenna element type configured on one  
5 or more deployed panels.

1                   40.     The spacecraft as recited in claim 39, wherein the first antenna element  
2 type comprises a helical antenna element, and the second antenna element type and the third  
3 antenna element type comprise planar antenna elements.

1                   41.     The spacecraft as recited in claim 39, wherein the first antenna element  
2 type comprises a helical antenna element of a first length, the second antenna element type  
3 comprises a helical antenna element of a second length, and the third antenna element type  
4 comprises a planar antenna element.

1                   42.     The spacecraft as recited in claim 31, further comprising:

2 a second antenna array comprising one or more antenna elements.

1 43 The spacecraft as recited in claim 42, wherein at least some of the one  
2 or more antenna elements of the second antenna array are of the first antenna element type.

1 44. The spacecraft as recited in claim 42, wherein at least some of the one  
2 or more antenna elements of the second antenna array are of the second antenna element type.

1 45. The spacecraft as recited in claim 42, wherein at least some of the one  
2 or more antenna elements of the second antenna array comprise antenna elements of the first  
3 antenna element type and the second antenna element type.

1 46. The spacecraft as recited in claim 42, wherein the second antenna array  
2 has a coincident or overlapping frequency band as the first antenna array.

1 47. The spacecraft as recited in claim 42, wherein the one or more antenna  
2 elements of the second antenna array are interleaved with at least a portion of the antenna  
3 elements of the first antenna array.

1 48. The spacecraft as recited in claim 47, wherein the antenna elements of  
2 the first antenna array that are interleaved with the one or more antenna elements of the  
3 second antenna array are of the first antenna element type, and at least a portion of the  
4 antenna elements of the first antenna array that are not interleaved with the one or more  
5 antenna elements of the second antenna array are of the second antenna element type.

1 49. The spacecraft as recited in claim 42, wherein the antenna elements of  
2 the first antenna array and the one or more antenna elements of the second antenna array are  
3 configured on a spacecraft bus.

1 50. The spacecraft as recited in claim 42, wherein the one or more antenna  
2 elements of the first antenna element type of the first antenna array and the one or more  
3 antenna elements of the second antenna array are configured on a spacecraft bus, and the  
4 plurality of antenna elements of the second antenna element type of the first antenna array are  
5 configured on one or more deployed panels.

1 51. The spacecraft as recited in claim 50, wherein the one or more antenna  
2 elements of the first antenna element type of the first antenna array and the one or more  
3 antenna elements of the second antenna array are interleaved, and wherein the first antenna

4 element type comprises a helical antenna element, the second antenna element type  
5 comprises a planar antenna element, and the one or more antenna element of the second  
6 antenna array comprise helical antenna elements.

1 52. The spacecraft as recited in claim 42, wherein the one or more antenna  
2 elements of the first antenna element type of the first antenna array, the plurality of antenna  
3 elements of the second antenna element type of the first antenna array, and the one or more  
4 antenna elements of the second antenna array are configured on a spacecraft bus, and wherein  
5 the first antenna array comprises a plurality of antenna elements of a third antenna element  
6 type configured on one or more deployed panels.

1 53. The antenna as recited in claim 52, wherein the first antenna element  
2 type comprises a helical antenna element, the second antenna element type and the third  
3 antenna element type comprise planar antenna elements, and the one or more antenna  
4 elements of the second antenna array comprise helical antenna elements.

1 54. The antenna as recited in claim 52, wherein the first antenna element  
2 type comprises a helical antenna element of a first length, the second antenna element type  
3 comprises a helical antenna element of a second length, the one or more antenna elements of  
4 the second antenna array comprise helical antenna elements of a third length, and the third  
5 antenna element type comprises a planar antenna element.

1 55. The antenna as recited in claim 54, wherein the first length, the second  
2 length and the third length may all be different lengths, or two or more of the first length, the  
3 second length and the third length may be the same length.

1 56. The spacecraft as recited in claim 42, wherein the first antenna array  
2 comprises a Navigation Warfare Global Positioning System antenna.

1 57. The spacecraft as recited in claim 42, wherein the second antenna array  
2 comprises a Earth Coverage Global Positioning System antenna.

1 58. The spacecraft as recited in claim 42, wherein at least one of the first  
2 antenna array and the second antenna array comprises a phased array antenna.

1 59. The spacecraft as recited in claim 42, wherein at least one of the first  
2 antenna array and the second antenna array comprises an active phased array antenna.

1                   60.     The spacecraft as recited in claim 42, further comprising a third  
2     antenna array comprising one or more antenna elements.